Environmental Tobacco Smoke

Environmental tobacco smoke (ETS), also called "secondhand smoke," is the combination of two forms of smoke from burning tobacco products:

- Sidestream smoke, or smoke that is emitted between the puffs of a burning cigarette, pipe, or cigar, and
- Mainstream smoke, or the smoke that is exhaled by the smoker.

When a cigarette is smoked, about half of the smoke generated is sidestream smoke, which contains essentially the same compounds as those identified in the mainstream smoke inhaled by the smoker. Some of the chemicals in ETS include substances that irritate the lining of the lung and other tissues, carcinogens (cancer-causing compounds), mutagens (substances that promote genetic changes in the cell), and developmental toxicants (substances that interfere with normal cell development). Tobacco smoke is known to contain at least 60 carcinogens, including formaldehyde and benzo[a]pyrene, and six developmental toxicants, including nicotine and carbon monoxide.

Nonsmokers who are exposed to ETS absorb nicotine and other compounds just as smokers do. As the exposure to ETS increases, the levels of these harmful substances in the body increase as well. Although the smoke to which a nonsmoker is exposed is less concentrated than that inhaled by smokers, research has demonstrated significant health risks associated with ETS.

Health Effects Associated With ETS Exposure

In 1986, two landmark reports were published on the association between ETS exposure and the adverse health effects in nonsmokers: one by the U.S. Surgeon General and the other by the Expert Committee on Passive Smoking, National Academy of Sciences' National Research Council (NAS/NRC). Both of these reports concluded that:

- ETS can cause lung cancer in healthy adult nonsmokers;
- Children of parents who smoke have more respiratory symptoms and acute lower respiratory tract infections, as well as evidence of reduced lung function, than do children of nonsmoking parents; and
- Separating smokers and nonsmokers within the same air space may reduce but does not eliminate a nonsmoker's exposure to ETS.

In 1992, the U.S. Environmental Protection Agency (EPA) confirmed the above findings in its study on the respiratory health effects of ETS. In addition, the EPA classified ETS as a Group A carcinogen—a category reserved only for the most dangerous cancer-causing agents in humans. The EPA report, a compilation of 30 epidemiological studies that focused on the health risks of nonsmokers with smoking spouses, concluded that there is a strong association between ETS exposure and lung cancer. Scientists estimate that ETS is responsible for approximately 3,000 lung cancer deaths per year among nonsmokers in the United States. Recent studies and the EPA's report point to a 20–percent increased risk of lung cancer in nonsmokers due to ETS.

In response to evidence that ETS causes diseases beyond lung cancer and respiratory problems in children, the California Environmental Protection Agency (Cal/EPA) conducted a comprehensive assessment of the range of health effects connected with ETS exposure. In 1999, the National Cancer Institute (NCI) published the Cal/EPA's results as part of its Smoking and Tobacco Control monograph series in *Health Effects of Exposure to Environmental Tobacco*

Smoke. The following table outlines the health effects that were found to have a significant association with ETS exposure.

Table 1: Health Effects Associated With ETS Exposure

Developmental Effects	▸ Low birth weight or small for gestational age ▸ Sudden Infant Death Syndrome (SIDS)
Respiratory Effects	▸ Acute lower respiratory tract infections in children ▸ Asthma induction and exacerbation in children ▸ Chronic respiratory symptoms in children ▸ Eye and nasal irritation in adults ▸ Middle ear infections in children
Carcinogenic Effects	▸ Lung Cancer ▸ Nasal Sinus Cancer
Cardiovascular Effects	▸ Heart disease mortality ▸ Acute and chronic coronary heart disease morbidity

Other health effects that were found to be possibly associated with ETS were as follows:

- Spontaneous abortion (miscarriage);
- Adverse impact on cognition and behavior during child development;
- Exacerbation of cystic fibrosis (a disease marked by overproduction of mucus in the lungs);
- Decreased lung function; and
- Cervical cancer.

However, further research is needed to confirm the link between the above health risks and ETS.

Carcinogenic Effects of ETS

More than 3,000 chemicals are present in tobacco smoke, including at least 60 known carcinogens such as nitrosamines and polycyclic aromatic hydrocarbons. Some of these

compounds become carcinogenic only after they are activated by specific enzymes (proteins that control chemical reactions) found in many tissues in the body. These activated compounds can then become part of deoxyribonucleic acid (DNA) molecules and possibly interfere with the normal growth of cells. Tobacco also contains nicotine, a chemical that causes physical addiction to smoking and makes it difficult for people to stop smoking.

Although much of the research into the carcinogenicity of ETS has focused on lung cancer, ETS has also been linked with other cancers, including those in the nasal sinus cavity, cervix, breast, and bladder. The role of ETS in the development of nasal sinus cancer has been investigated in three recent studies; all three showed a significant positive association between ETS exposure and the development of nasal sinus cancer in nonsmoking adults. Several studies that focused on ETS as a risk factor for cervical cancer have shown a possible association between ETS and cancer of the cervix, although no specific conclusions could be made. Similarly, studies of the relationship between ETS exposure and breast cancer suggested an association between the two, but the evidence was weak. Although active smoking has been identified as a cause of bladder cancer, the results of studies focusing on ETS and bladder cancer have not been conclusive. More research is needed into the impact of ETS on nonsmokers' risk for cancers of the cervix, breast, and bladder.

Public Policies Restricting Smoking

Studies dating from the early 1970s have consistently shown that children and infants exposed to ETS in the home have significantly elevated rates of respiratory symptoms and respiratory tract infections. These findings prompted recommendations that ETS be eliminated from the environment of small children.

In adults, ETS can worsen existing pulmonary symptoms for people with asthma and chronic bronchitis, as well as for people with allergic conditions. Even individuals who are not allergic can suffer eye irritation, sore throat, nausea, and hoarseness. Contact lens wearers can find tobacco smoke very irritating.

Following the release of the 1986 reports by the Surgeon General and the NAS, many new laws, regulations, and ordinances were enacted that severely restrict or ban public smoking. With the release of new studies such as the 1999 NCI monograph, many more such laws can be expected:

- On the Federal level, the General Services Administration issued regulations restricting smoking to designated areas only in Federal office buildings. Many agencies within the Public Health Service, which includes the National Institutes of Health, have banned smoking completely.

- By law, smoking on all airline flights of 6 hours or less within the United States is banned; however, in practice, all U.S. airlines have banned smoking on all domestic flights. All interstate bus travel is smoke free.

- ETS meets the criteria of the Occupational Safety and Health Administration (OSHA) for classification as a potential occupational carcinogen. (OSHA is the Federal agency responsible for health and safety regulations in the workplace.)

- The National Institute for Occupational Safety and Health (NIOSH) is another Federal agency that is concerned with ETS exposure in the workplace. NIOSH conducts ETS-related research, evaluates work sites for possible health hazards, and makes safety recommendations. NIOSH recommends that ETS be regarded as a potential occupational carcinogen, in conformance with the OSHA carcinogen policy, and that exposures to ETS be reduced to the lowest possible levels.

- Currently, nearly every state has some form of legislation to protect nonsmokers; some states require private employers to enact policies that protect employees who do not smoke. Information about state-level tobacco regulations can be accessed through the Centers for Disease Control and Prevention’s (CDC’s) State Tobacco Activities Tracking and Evaluating (STATE) System Web site, which can be found at http://www2.cdc.gov/nccdphp/osh/state on the Internet. In addition to state legislation, a number of local jurisdictions have enacted ordinances addressing nonsmokers' rights, and most are more restrictive than their state counterparts.

Additional Resources About the Effects of ETS

The 1999 NCI monograph *Health Effects of Exposure to Environmental Tobacco Smoke* can be ordered from the Cancer Information Service (see below). U.S. residents can order the monograph online at http://publications.nci.nih.gov on the Internet. (The monograph can also be viewed and downloaded from this Web site.)

Additional information on the health effects of tobacco is available from the CDC's Tobacco Information and Prevention Source (TIPS) at http://www.cdc.gov/tobacco on the Internet. This program collects and distributes reports and news about tobacco, lists services available for people trying to quit using tobacco products, and produces publications about tobacco and the dangers of its use.

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Sources of National Cancer Institute Information

Cancer Information Service
Toll-free: 1–800–4–CANCER (1–800–422–6237)
TTY (for deaf and hard of hearing callers): 1–800–332–8615

NCI Online
Internet
Use http://www.cancer.gov to reach NCI's Web site.

CancerMail Service
To obtain a contents list, send e-mail to cancermail@icicc.nci.nih.gov with the word "help" in the body of the message.

CancerFax® fax on demand service
Dial 301–402–5874 and listen to recorded instructions.

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